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## Yield Gap Analysis of Wheat in District Sonbhadra

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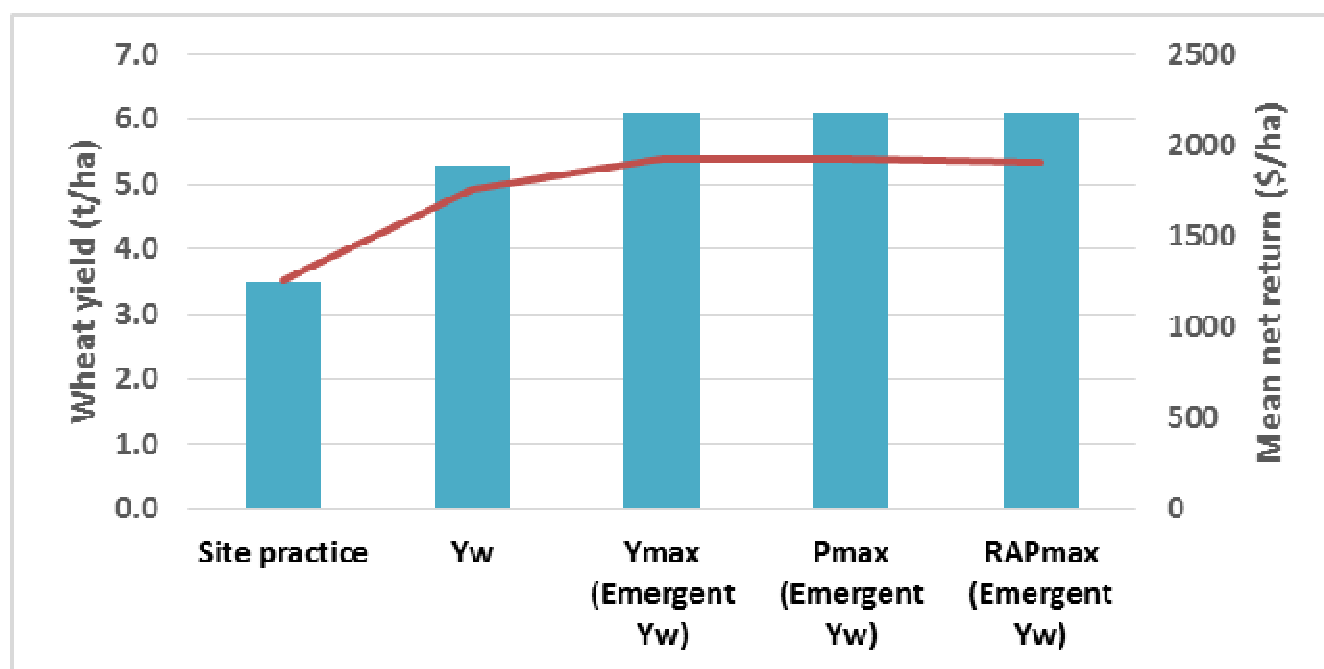
**Abstract:** Uttar Pradesh is the largest wheat growing and producing a state in India and undergone rapid strides since green revolution. The present paper tracks the yield gap analysis of wheat production in district Sonbhadra, Uttar Pradesh, based on the secondary data. Compound annual growth rate, instability indices, efficiency gap and Gini inequality index were computed to analyse the performance trend. Findings indicated that wheat area registered an increasing trend, while production and productivity had irregular trends over the years. District Sonbhadra, in UP, found under positive growth coupled with low instability which is a good indicator of performance. Also under positive growth - high instability quadrant in productivity, and production, which warrants for appropriate strategies in terms of risk management. All the selected variables showed an increase in variation. However, relatively high variation and inequality were observed in productivity and production, respectively, in comparison to the area. District level differences in productivity led to performance gaps in Sonbhadra, Uttar Pradesh. The study suggested for formulating new research and policy interventions followed by regional prioritization for additional wheat production as well as improving the crop acreage.

**Key words:** Sonbhadra, wheat, crop, risk, management, yield, gap, acreage, variation, additional

### Introduction:

Food security of India depends on wheat crops. The study was conducted in Sonbhadra region of Uttar Pradesh to assess yield gap at farmers' field. Sonbhadra was purposively selected because of large area under the wheat crop system. Out of the this district blocks with maximum area under wheat system were selected. From the selected villages, 120 farmers were selected through proportionate random sampling from small (up to 2.00 hectares), medium (above 2.00–4.00 hectares) and large (more than 4.00 hectares) farmers. There is a yield gap on all the farms. The yield gap-II was more than the yield gap-I.[1] The major constraints responsible for yield gap were late sowing/transplanting, higher prices of seed, non-availability of fertilizer at sowing time, lack of funds with farmers and infestation of pest and disease. There is further scope to increase productivity on the farms by managing the constraints. Providing quality inputs to the farmers at right time in sufficient quantity can help in reducing yield gap. Increasing agricultural productivity or yield is critical to economic growth and development. This can be achieved by using improved agricultural technologies and management systems. Yield refers to production per unit

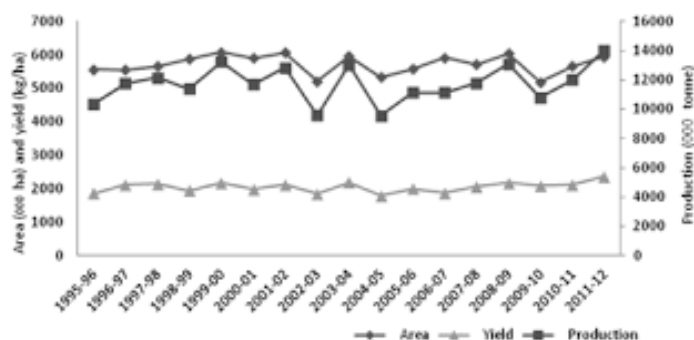
area. Yield gap is calculated by subtracting achieved average yield from the yield potential. Understanding yield gap is very crucial for it can assist in crop yield predictions since yield potential shows the probable future productivity to be achieved. [2]



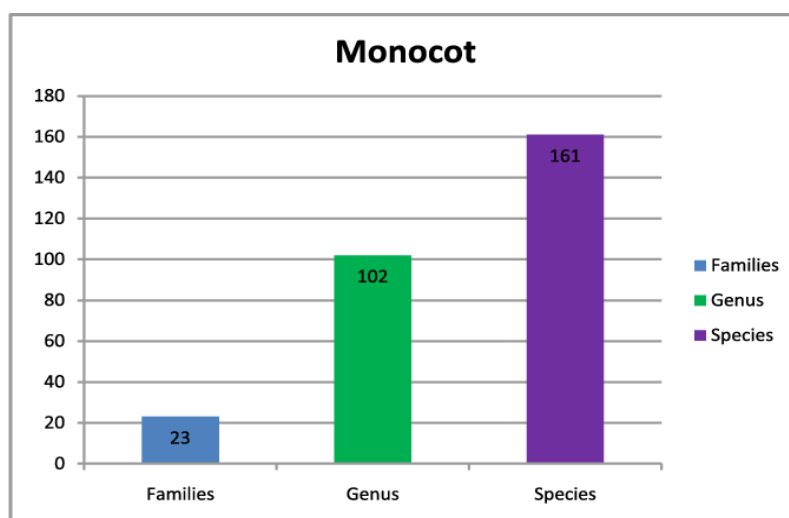
Also, information on determinants of yield gap can be used in policy interventions for enhancing crop production. In order to meet increasing demands of food due to increasing population and income, food production in India need to be increased. However, lately there has been a significant slow-down in the growth rate in the cultivated area, production and yield. The production of food grains in India increased considerably since 1960s due to increase in arable area, large-scale cultivation of high yielding semi dwarf varieties and increased applications of irrigation, fertilizers and pesticides. India became food secure in the last three decades, at gross level, because of increase in food production. The food security of India and other countries in South Asia is, however, now at risk due to increase in population. By 2050, India's population is expected to grow to 1.6 billion people from the current level of 1.1 billion. The gradual increase in environmental degradation through intensive cropping systems is further compounding the problem. There is now a great concern about decline in soil fertility, change in water table depth, rising salinity, resistance of harmful organisms to many pesticides and degradation of quality of irrigation water in north-western India. It is very important to know how much additional food can be produced in different regions to meet the increasing demand. In view of such stagnations, we need to know if the genetic yield ceiling has been reached for critical crops or if there are some other factors that are not allowing yields to increase. Estimates of these potentials can assist in quantifying the carrying capacity of agro ecosystems. Rain-fed agriculture in India is practiced on 94 million hectares (M ha). These areas generally have bypassed from the benefits of green revolution and as a result, grain yields remain low. [3]

The cultivated area, production and yield of different crops were obtained from the published data of the Ministry of Agriculture, Government of India. These yields were considered as the measured yields to calculate yield gaps. It may be noted that state averages are the means of irrigated and rainfed areas and hence rain-fed yields will be overestimated, especially in crops such as wheat where irrigated areas are large. The yield gaps were calculated from all three expressions of potential yields as follows:

1. Simulated rain-fed potential yield gap = simulated mean rain-fed potential yield measured yield (state average).
2. Experimental yield gap = experimental potential yield (plant breeder's trials) – measured yield (state average).
3. On-farm yield gap = on-farm potential yields – measured yield (state average).[4]



In all the crops the degree of yield gap was quite remarkable among all size groups of farms. However, the extent of yield gap was comparatively very high on marginal and small farms. The yield gaps were found negatively associated with farm size group. Thus there is ample scope to increase the productivity of all the major crops across the farm size group in the study area. It was observed that on the overall basis 'Source of seed, Capital use, Meeting with ADO/Ag. Scientist and Technology adoption level had significant negative impact on the yield gap of all the major crops.[5]



Regression results on determinants of yield gap revealed that technology adoption level is one of the important determinants of yield gap in all the three crops cultivated in the study area. Therefore, farmers are required to be educated to adopt full package of practice along with the provision of timely availability of agro inputs in required quantity. ADO/Ag. scientist meeting per year was also found important determinants of yield gap among all the crops. So increasing the frequency of meetings and interaction with ADO/Ag. scientist will help in increasing the yield of the crops.[6]

### Discussion

Wheat production is required to supply food for the world's population, and increases in production will be necessary to feed the expanding population. Estimates show that production must increase by 1 billion metric tons to meet this demand. One method to meet future demand is to increase wheat yields by

reducing the gap between actual and potential yields. Potential yields represent an optimum set of conditions, and a more realistic metric would be to compare actual yields with attainable yields, where these yields represent years in the record where there is no obvious limitation.[7]



### **Role of Biofertilizer in maintaining nutritional status of soil in Sonbhadra**

This study was conducted to evaluate the yield trends, attainable yields, and yield gaps for the 10 largest wheat producing countries in the world and more localized yield statistics at the state or county level. These data were assembled from available government sources. Attainable yield was determined using an upper quantile analysis to define the upper frontier of yields over the period of record and yield gaps calculated as the difference between attainable yield and actual yield for each year and expressed as a percentage of the attainable yield. In all countries, attainable yield increase over time was larger than the yield trend indicating the technological advances in genetics and agronomic practices were increasing attainable yield. Yield gaps have not shown a decrease over time and reflect that weather during the growing season remains the primary limitation to production. Yield gap closure will require that local producers adopt practices that increase their climate resilience in wheat production systems.[8,9]

District Sonbhadra is one of the largest district of the Uttar Pradesh with the total geographical area of 680961 hectare out of which 79937 hectare is net sown area. The district is situated in south eastern part of the state. It lies between 23.520 to 25.320 northern latitude and between 82.720 to 83.330 eastern longitude. The district is surrounded by district Chandauli, Varanasi part of Mirzapur district in north and bordered by state of Madhya Pradesh and Chattisgarh in the south, state of Bihar, Jharkhand and part of Chattisgarh are in the east, while state of Madhya Pradesh is in the west.

On the basis of its topography, soil, micro-climate, the district has 4 distinct characters viz. the northern part of the district which is plains of Ganga, Son, Karmanasa and Belan rivers; the southern part of the district is plateau region transected by Son, Renu, Bihul and Kanhar rivers, eastern part is plain land of Belan and Karmanasa rivers while western part is also plain region of Belan river.[10,11]





The district consists of three sub division (Tehsil) and 8 blocks with headquarter at Robertsganj. There are 67 Nayaya Panchyat, 501 Gram panchayat and 1443 revenue village in the district.

As per the census 2001, the total population of the district is 15.05 Lac comprising of 7.92 lac males and 7.13 lac females. Out of the total population, 82% population is residing in rural areas and 18% in Urban areas. The schedule cast and scheduled tribe population of the district is 625555 (41.56%) and 493 (0.00033%) respectively. Average literacy percent in the district is 49.32%. There are 167252 land holdings which cover about 231899 hectare of land. Out of total land holdings 135855 (about 81%) are less than two hectares while only 12624 (0.08%) are above four hectares.

The district is characterized by warm and humid climate from June to September and dry and cool weather from October to February-March. April to June are characterized by hot winds. The mean maximum & minimum temperature recorded in the past are 45.80c and 2.80c respectively. The average rainfall received in the district in last five year was much below from the normal average of 997mm.[12,13]

Sonebhadra district is very rich in forest vegetation which has very good bio diversity. The forest in the district is spread over 333608 hectare which is approximately 49.09% of total geographical area but the actual forest cover is only 36.50% of total geographical area, which is very rich in Medicinal plant and forest biodiversity.

The major cropping system of the district is Rice-Wheat. The major crops of the district are Paddy, Wheat, Arhar, Gram, Lentil, Line seed, Sesamum, Pea and Vegetables like Tomato, Brinjal, Chilli, Cucurbits and broad beans. The cattle breeds are mostly non-descriptive with low milk productivity. Goat & sheep are other domestic animals dominant in district. The lack of irrigation facilities is one of the

major factors affecting production and productivity of crops in this district. Major source of irrigation is canal supplying water from the reservoirs after storing rain water. This water is not sufficient for providing irrigation to Kharif and Rabi season crops. Management of red, black soils with shallow depth and rocky nature located in undulated terrain is another problem of the district.[10]

Sonbhadra has a sex ratio of 996 females for every 1000 males. In census enumeration, data regarding child under age six were also collected for districts Sonbhadra. There were total 323,092 children under age six against 302,834 of 2001 census. Of total 323,092 male and female were 167,870 and 155,222 respectively. Child sex ratio as per census 2011 was 925 compared to 956 of census 2001. In 2011, children under age six formed 17.35 percent of Sonbhadra District compared to 20.69 percent of 2001. There was net change of -3.34 percent in this compared to previous census



Out of the total Sonbhadra population for 2011 census, 16.88 percent lives in urban regions of district. In total 314,342 people lives in urban areas of which males are 167,999 and females are 146,343. Sex Ratio in urban region of Sonbhadra district is 871 as per 2011 census data. Similarly child sex ratio in Sonbhadra district was 868 in 2011 census. Child population (0-6) in urban region was 38,169 of which males and females were 20,434 and 17,735. This child population figure of Sonbhadra district is 12.16% of total urban population. there are 11.7% urban people belong to scheduled casts and 3.2% urban people belong to scheduled tribes.

Average literacy rate in Sonbhadra Urban as per census 2011 is 84.31% of which males and females are 90.73% and 76.93% literates respectively.[11,12]

## Results

The Valley of Son and Belan Rivers abounds in caves which were the earliest dwellings of the primeval inhabitants. This area had been the centre of activities of pre-historic man which is evident from the rock paintings (pre-historic cave art) found in abundance in this region. These paintings are of the periods ranging from Mesolithic to Paleolithic ages.



### Cultural food

Based on evidence from religious and cultural perspectives of Ramayana and the Mahabharat, Huyen found here is the cultural symbol. By Jarasandh many rulers in the Mahabharat were maintained prisoner here. Sonbhadra, whose ancient name was Gramputra or Gupt Kashi, was built by the ancient king Putrak for his queen Paatali. It is said that 'Bhars' had settlements along with Chero, Searis and Kharwar communities in the district up to fifth century there was the rule of "Chandel Rajput" kings on Vijaygarh Fort. This district was famous as second Kashi during 11th to 13th centuries. In the 9th century B.C., the Brahmadutt dynasty was subdivided by Nagas. Kushan and Nagas also held supremacy over this region before the advent of the Gupta period. After the death of Harshvardhan in the latter half of the 7th century, it remained under the control of the Gurjara-Pratihars till 1025 before they were driven out by Mahmud of Ghazni. This area was under the administration of various Governors of Mughal emperors. Some of the forts such as Agori Fort were under the control of Madan Shah.[12,13]

During the 18th century, the district came under the control of the Narayan rulers of Benares State, who built or occupied several fortresses in the district. In the decade after 1775, the British took over administrative control of most of the territory of the rajas of Benares. The British district of Mirzapur included present-day Mirzapur and Sonbhadra districts, with all of present-day Sonbhadra district included in Robertsganj tehsil. On 4 March 1989, Sonbhadra district was divided from Mirzapur district.



Agori Barhar an impartible estate, it originally comprised the present districts of Sonbhadra and part of Mirzapur district. It was divided into two parganas of Agori, which was 18,477 km<sup>2</sup> (7,134 sq mi) and Barhar, which was 11,290 km<sup>2</sup> (4,360 sq mi) in area, thus making it the largest estate in area in the United Provinces of Agra and Oudh. Chandel Rajput Raja Paramardideva of Mahoba, ancestor of the family and contemporary of Raja Prithviraj III of Delhi, who attacked Mahoba as the Raja was the ally of Raja Jaichand of Kannauj, and occupied it for a time. Raja Paramardi Deva fled for his life with his friends and family, and though Mahoba was re-occupied by the Raja with the help of Jaichand of Kannauj, the glory of the capital never returned. During this time one of the sons of Raja Paramardi Deva, called Ashajit, fled eastwards in the turmoil that followed. His sons or grand sons called Barimal and Bharimal, captured Agori from the Kaharwar Raja and made themselves the independent rulers of Agori and Barhar. The elder brother Barimal took the kingdom of Agori and Barhar, and the younger brother Bharimal became the independent ruler of Bardi (Princely state ruled by Chandel -Rajput ruler). Within this zamindari, sixteen talukas have been assigned for the maintenance of the Babus (collateral agnates).[14]



Another Princely state in sonbhadra in Vijaygarh.it was also ruled by Chandel Dynasty after that by Narayan dynasty.

The erstwhile Maharaja is His Highness Raj-Rajeshwar Maharajadhiraja Shri Maharaja Bhuvaneshwar Prasad Singh. His family were the rulers of Singrauli. Their rule extended from Singrauli to Sasaram in Bihar (includes Sonebhadra). With an area of about

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### Conclusions

The Manager (QC)/ Technical Assistants must send details of daily arrivals (variety wise) in the mandis and purchases made by them, purchases made by the State Govt./Agencies as well as the traders along with the prevailing market rates to the District Offices, which will in turn furnish the position of whole district to the Control Room set up at Regional Office, Lucknow (agmcrup.fci@nic.in). The Area Managers shall also ensure feeding of data in Procurement Monitoring System (PMS). Monitoring of market price of wheat should also be undertaken on AGMARK portal to prevent any distress sale of wheat. GOI has directed that purchase made by Govt. Agencies at MSP be reported in AGMARK using URL [www.agmarknet.gov.in/login.aspx](http://www.agmarknet.gov.in/login.aspx). FCI district offices should ensure that centers opened by FCI are linked in AGMARK Portal and data is fed on regular basis on the portal. Comments on daily report by AGMARKNET of below MSP purchase are to be replied promptly. District offices should coordinate with State Govt. for feeding of data on portal. Monitoring and reporting of arrivals and procurement by different agencies including pvt. traders/millers on daily basis is considered to be an effective tool to curb the possibility of recycling or fictitious procurement. Therefore, Area Managers should personally monitor these and ensure timely reporting to Regional Office. Any delay in submission of daily procurement figures by the State Govt. should serve as adequate warning signal to District Offices and it should become very vigilant to obviate any possibility of recycling/ fictitious procurement. Any instance of state agencies undertaking procurement beyond period fixed by GOI be promptly brought to the notice of Regional Office and State Govt. The final figures of procurement must be intimated within 03 days of cessation of procurement period prescribed by GOI[15]

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